IMPACT OF SUPPLEMENTATION OF SELECTED ARID FOODS ON NUTRITIONAL STATUS AND RISK FACTORS ON MILD HYPERTENSIVE PATIENTS

मन्द उच्चरक्तचाप के मरीजों के पोषणीय स्तर एंव जोखिम कारणों पर चयनित शुष्क खाद्य पदार्थों की अनुपूर्ति का प्रभाव

A SYNOPSIS

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Introduction

Blood Pressure

Blood pressure is one of the most important major modifiable risk factors for cardiovascular disease (Carretero et al. 2000). Hypertension or High Blood Pressure which is also called arterial hypertension, is the chronic medical condition in which the blood in the arteries is elevated. Blood pressure is measured with two readings i.e. *systolic* and *diastolic.* This depends on the action when the heart muscle is in the contracting phase of the cardiac cycle (then reading equivalent to systolic scale is recorded) or relaxed between beats (then reading equivalent to diastolic scale is recorded). *The Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure* (Chobanian et al. 2003) has classified hypertension as:

Classification of Blood Pressure in the Adults

BP Classifications	Systolic pressure	Diastolic pressure
	mmHg	mmHg
Normal	90–119	60–79
Mild(Pre) hypertension	120–139	80–89
Stage 1 hypertension	140–159	90–99
Stage 2 hypertension	≥160	≥100
Isolated systolic hypertension	≥140	<90

Source- JNC7, Chobanian et al. 2003)

Types of Hypertension

Primary Hypertension

Hypertension of unknown etiology is known as Primary Hypertension. It is also known as essential hypertension. About 90-95% cases of hypertension are in the category of primary hypertension (Carretero et al. 2000). Primary hypertension mostly occurs due to the individual interaction between environmental and genetic factors.

Secondary Hypertension:

Elevated blood pressure due to other conditions which affect the kidneys, arteries, heart or endocrine system is known as Secondary Hypertension. About 5-10% of cases are caused by secondary hypertension (Mahan et al. 2004).

Signs and Symptoms:

Hypertension is asymptomatic for year that's why it is also called as silent killer.

Primary hypertension

It has no symptoms and its identification is usually through screening. According to Marshall et al. (2012) the presence of symptoms like headache, dizziness, palpitations/racing heart, sweating, tiredness, neck pain, nausea/vomiting, chest pain, visual changes ,lightheadedness, vertigo, tinnitus (buzzing or hissing in the ears), fainting episodes at some stage of life are indicative of the presence of primary hypertension.

Secondary hypertension

Secondary hypertension arises as a result of another disease.

Effect of High Blood Pressure

High Blood Pressure is a hidden danger which can affect the body functions badly. It is a kind of chronic disease and most of the times it remains untreated for a long time. The untreated and uncontrolled management of hypertension cause severe consequence ranging from disability, a poor quality of life or even a fatal heart attack. But with proper life style modification, dietary supplements and proper treatment these life threatening problems may be resolved. According to the American Heart Association (AHA, 2014) the High Blood Pressure may act as a silent killer as High Blood Pressure shows no symptoms but still it damages arteries, heart and other organs. Its catastrophic effects on body organs are:

> ***Heart Stroke:*** Persons with High Blood Pressure have a high risk of stroke. High Blood Pressure increases the stroke risk 4-6 times (AHA 2014).
>
> ***Heart Failure:*** According to American Heart Association, people with symptoms of High Blood Pressure suffer from congestive heart failure and the toll is as high as 75% (AHA 2014).
>
> ***Heart attack:*** The damage to arteries as a result of hypertension increases the risk of heart attacks (AHA 2014).
>
> ***Kidney disease or failure:*** constant presence of untreated High Blood Pressure may cause adverse effects on arteries around the kidney as they may become weak, narrow or harden. This affects the blood filtering capability of kidneys. As a result High Blood Pressure is the second most leading cause of kidney failure (AHA 2014).

Damage to arteries: Healthy arteries are flexible, strong and elastic. But due to High Blood Pressure, the increased pressure of blood flowing through the arteries can cause a variety of problems (Staff 2014).

Other threats: Other threats of hypertension includes damage to eyes (eye blood vessel damage, fluid buildup under the retina, nerve damage), sexual dysfunction, bone loss & sleeping disorders.

The total life expectancy of a person without High Blood Pressure is around five years longer than that of hypertensive patient. The total cost of high blood pressure is around $46.4 billion (AHA 2014).

Risk factors

The exact cause is not clear but the following factors increase the risk of hypertension

- Overweight
- Family History
- Sedentary life style
- Ageing
- Tobacco, Smoking and alcohol drinking
- Stress
- Certain chronic conditions

Dietary Management

DASH Diet (Dietary Approaches to Stop Hypertension): Blood pressure reduces with diet having low total fat, low cholesterol, low saturated fat, so DASH diet includes whole grains, fish, nuts, vegetables, and fruits. It is rich in potassium, vitamin E, vitamin C, Calcium, magnesium, proteins and fiber (Appel et al. 1997).

Kair (Capparis Decidua)

The Greek name Kapparis is derived the Persian name Kabar, Caper (Brown et al. 2000). Pickled caper have been used as a condiment for over 2000 years. The genus Capparis comprises 250 species including shrubs, trees and woody climbers. Capparis Decidua is one of the important multipurpose woody species of desert and arid regions of the Indian subcontinent, Africa and Saudi Arabia. Capparis Decidua commonly known as Kair in Rajasthan, Karil in Uttar Pradesh, Ker in Gujarat, Teent in Haryana, Della in Delhi and Punjab and Nepti in Western Maharashtra etc, is a densely branching shrub or small tree of

the Thar Desert (Kaul 1963). It is also found in the subtropical and tropical zones and other arid regions in Southern Asia with a mass of slender, 4-5 m high, or occasionally a small tree with many green vine-like apparently leafless branches, hanging in bundles (Chandra et al. 1994, Singh and Singh 2011).

As an estimate, Kair is distributed over 3,540 km^2 in the plains of Bikaner and Jodhpur districts of Rajasthan, with an estimated annual production of 7,000 tones of fruit (Chandra et al. 1994, Singh and Singh 2011).

Cluster Beans (Cyamopsis Tetragonoloba)

The Cluster Beans(Cyamopsis Tetragonoloba) or guar is also known as Calcutta Beans or Siam Beans. These beans are grown in areas where annual rainfall is very low. Guar is native to India and Pakistan especially in the arid areas. About 80% of world demand of gaur is fulfilled by India and Pakistan. In India most of production of guar gum is limited to the arid areas of Rajasthan (bibd.uni-giessen.de 2014).

Flaxseed (Linum Usitatissimum)

Flaxseed is an ancient crop. Considering its health benefits in the 8th century, King Charlemagne passed laws requiring his subjects to consume it (Magee 2014). It belongs to the family of Linaceae and the genus Linum. It is also known as Alsi, Agase, Atasi, Jawas, Pesi, Ali Vidai, Tishi, Flax, and Flax Weed. There are about 100 spices of Flaxseed all over the world. It's cultivated for its fiber, seed and oil.

Therapeutic uses and nutritional composition of Kair, Cluster Beans and Flaxseed

Kair is traditionally used to cure hypertension, diabetes, stomach pain, vomiting, toothache, arthritis, asthma, cough, inflammation, intermittent fevers, malaria, rheumatism and swelling etc. The Kair fruit has laxative, astringent and vermifuge properties (Goyal et al. 2009; Joseph et al. 2011; Singh and Mishra 2011).

The therapeutic uses of Cluster bean or guar (Cyamopsis Tetragonolobus) are that it helps in body pain, diabetes, arthritis, anorexia, constipations (Goyal et al. 2009). Cluster Beans (Cyamopsis Tetragonoloba) are a rich source of soluble fiber and are known for their cholesterol lowering effect (Pande et al. 2010).

The Dietary Flaxseed supplementation helps to improve symptoms of cardiovascular disease, Cancer, Diabetes, Inflammation, Hot Flashes etc and it also it lowers the LDL Cholesterol levels (Magee 2014).

The nutritional compositions of Kair, Cluster Beans and Flaxseed is shown in the Table below

Composition(Nutrients)	**KAIR**	**CLUSTER BEANS**	**FLAXSEED**
Moisture (gms)	69.5	81	6.96
Protein (gms)	4.24	3.2	18.29
Fat (gms)	2.0	0.4	42.16
Ash (gms)	1.8	1.4	3.72
Fiber (gms)	4.24	3.2	27.3
Carbohydrates (gms)	18.2	10.8	28.88
Energy (Kcal)	107	16	534
Vitamin C (mg)	50	49	0.6
Iron (mg)	0.76	1.08	5.73
Calcium (mg)	Not Available	130	255
Phosphorous (mg)	Not Available	57	642
Potassium (mg)	-	230	813
Vitamin E(γ-Tocopherol) (mg)	744	----	19.95
Vitamin E(δ-Tocopherol) (mg)	206	----	0.31
ω-3 polyunsturated fatty acid (mg)	--	36.9	53.6
ω-6 polyunsturated fatty acid (mg)	--	25.3	--

Source: DeFilippis et al. 2006; Goyal et al. 2009; Zia-Ul-Haq et al. 2011; yadtek.com 2014; Agricultural_Research_Service 2014)

Importance of Proposed Investigations

Hypertension is one of leading cause of major disabilities and deaths. According to World Hypertension League Organization (WHL 2014) an estimated 18% of deaths (9.4 million) and 162 million years of life lost were attributed to increased blood pressure in 2010. Also 4 in 10 adults over age 25 are suffering from hypertension and in some countries 1 in 5 people had mild or pre hypertension (Vasan et al. 2002; Lawes et al. 2008; WHO 2013). Unhealthy diet is estimated to be related to about half of hypertension which includes uncontrolled diet management and food intake low in potassium. Physical inactivity is related to about 20% of hypertension and obesity is related to about 30% of hypertension. Excess alcohol and fat consumption also causes hypertension. About 30% related to increased salt consumption, and about 20% related to low dietary potassium (low fruit and vegetables). Being tobacco free is especially important for people with hypertension (Logo et al. 2010; WHL 2014).

As the statical data shows that hypertension is a major epidemic chronic disease which leads to other health hazards and affects organs to a severe extent. Also as people in India are vulnerable to hypertension a research work targeted to bring awareness towards alternative treatment is relevant. An intervention study using foods like Kair, Cluster Beans and Flaxseed is carried out to bring their effects to cure mild hypertension.

Objectives of study

The present study is designed with following objectives

1. To assess the Nutritional Status of patients suffering from mild Hypertension.
2. To evaluate the impact (on nutritional status and lipid profile) of intervention with the following arid foods in patients of mild hypertension
    - Kair (Capparis Deciduas) – 10 gm dried powder per day
    - Cluster Beans (Cyamopsis Tetragonoloba) - 10 gm dried powder per day
    - Flaxseed (Linum Usitatissimum) - 10 gm roasted seeds per day

Review of literature

A review of literature gives the investigator an excellent idea of the work done in the field of the study and helps to be in touch with recent developments in the field.

Prevalence of Hypertension

According to the studies done by Strong et al. (2005) 35 million people died in 2005 due to heart disease, stroke, cancer and other chronic diseases. Universal prevalence of Hypertension & Dyslipidemia is about 38.2% and 40.5% respectively (Thomas et al. 2006).

Gupta et al. (2004) revealed that there exists a relationship between body mass index and the prevalence of hypertension, hypercholestromia diabetes and metabolic syndromes.

A comparative study between rural and urban Indian population by Gupta (2007) revealed that the risk factor like obesity, truncal obesity, hypertension, high cholesterol, low HDL cholesterol and diabetes are seen more in urban areas than in rural areas.

The INTERHEART- South Asia Study (Yusuf et al. (2004) identified eight established coronary risk factors i.e. abnormal lipids, smoking, hypertension, diabetes, abdominal obesity, psychosocial factors, low fruit & vegetables consumptions and lack of

physical activity.

Therapeutic properties of Kair (Capparis Deciduas), Cluster Beans (Cyamopsis Tetragonoloba), Flaxseed (Linum Usitatissimum)

The astringent properties of Kair helps in bowels, remedies for bad breath and it is also claimed to cure cardiac troubles (Singh and Mishra 2011).The seed and fruit also have anti diabetic properties (Singh and Singh 2011; Goyal et al. 2011) in their study on Kair (teent) found significant lowering effect on plasma triglycerides, total lipids and phospholipid concentration.

The unripe Kair fruits are rich source of protein (18.6%) and their fruit pulp contains 8 mg/100g of vitamin C (Gupta et al. 1989).

In a compositional study of seed of Capparis Deciduas by Zia-Ul-Haq et al. (2011) it was found that it contains high amount of lipids 29.11% and crude fiber 10.44 %. They further found that the amino acid content of seeds indicate that glutamic acid (24.01 %) and aspartic acid (11.91 %) were present in highest concentrations, while methionine (0.75 %) and cysteine (0.34%) were found in low concentrations. Fatty acid composition of Kair seeds

showed a high content of linoleic acid (47.33%). In vitamin profile of Capparis Deciduas high amount γ-Tocopheol (744 mg/100g) was found in seed oil, while low amount β-tocopheol (1.04 mg/100g) was found and amount of other two δ-tocopheol and α-tocopheol are 206 mg/100g and 9.32 mg/100g respectively.

The Nutritive value of Cluster Beans per 110 g is Calories (34 Kcal), Protien (2 g), fat (0 g), dietary fiber (3.7 g), total Omega-3 fatty acids (36.9 mg), total Omega-6 fatty acids (25.3 mg),Vitamin C (17.9 -49 mg), Calcium (130 mg) and Potassium (230 mg) (Goyal et al. 2009; yadtek.com 2014).

Tuomilehto et al. (1989) conducted a study on Twenty-nine subjects using the gemfibrozil-guar gum combination, the results at the end of treatment period showed a significant decrease in serum total cholesterol by 27% and LDL-cholesterol by 39%.

In a study on rats by Pande et al. (2010) after feeding Cluster Beans for 8 weeks, the results showed significant decrease in serum cholesterol particularly in the LDL associated fraction. Hepatic lipid profile showed a significant decrease in both cholesterol and triglycerides.

The nutritive contents of Flaxseed contain omega Total Omega-3 fatty acids and Total Omega-6 fatty acids contents is 22.81 g/100g and 5.91 mg/100g respectively. Also it has 254 mg/100g Calcium and 813 mg/100g Potassium (NutritionData.com 2014).

In a study on 4440 persons (age 25 - 99 years) from both sexes by Djoussé et al. (2003) they found that the mean dietary linolenic acid intakes were 0.81 and 0.69 g/d for men and women respectively. Linolenic acid was found to be inversely related to plasma triacylglycerol concentrations in both sexes This suggests that the dietary linolenic acid might reduce cardiovascular disease risk.

Sesame is rich source of tocopherol and the total tocopherol content is 105.41μg/g, most of which is gamma-tocopherol (102.78 mg) (Rangkadilok et al. 2010). In a research on antihypertensive and antioxidant effects of dietary black sesame meal on 30 persons by Wichitsranoi et al. (2011) using black sesame meal at 2.52 g/d over 4 wk in 15 subjects reduced Systolic Blood Pressure by 8.3 mmHg as compare to control group of 15 persons, but there was a non-significant reduction in Diastolic Blood Pressure of 4.2 mmHg.

Paschos et al. (2007) in a study on Flaxseed showed that it is a source of alpha-linolenic acid (ALA). They reported that 12 weeks of dietary Flaxseed oil supplementation which is rich in ALA had beneficial effect in lowering blood pressure.

Methodology

The present investigation will be carried out to find out the effects of Kair (Capparis Deciduas), Cluster Beans (Cyamopsis Tetragonoloba), Flaxseed (Linum Usitatissimum) supplementation on the patients with mild hypertension. This section gives a detailed insight about the methodology to be adopted for this research work.

Sampling Procedure

Locale of study:

The study will carried out at Haldiram Moolchand Govt. Cardiovascular Science & Research Center, Bikaner, an Associate Hospital of S. P. Medical College and P. B. M. Hospitals, Bikaner.

Selection of subjects:

The subjects will be selected from the Outdoor Patient Department (OPD) of above mentioned Hospitals.

Subject selection criteria:

The subjects will be selected on the basis of the following criteria :

- Presence of mild-hypertension (systolic BP 120-139 mmHg & Diastolic BP 80-89 mmHg) (JNC7, Chobanian et al. 2003)
- Patients of either sex in the age group of 25-50 years
- Free from other health complications
- Patients willing to participate and cooperate during the study

Period of study

The study will be conducted over the period of 2 years based on availability of samples.

Study Design

The whole study design has been divided into three Phase. The interventional trail of subject collection and supplementation of arid foods for present piece of research work is done with prior approval from ethics committee.

Phase 1 Pre Experimental Design

The study will be carried out on 200 subjects with mild-hypertension. Once the patient is selected as per selection criteria the general information, medical history, biochemical, bio physical, anthropometric assessment and dietary information of the patient will be recorded.

Tools & Techniques

The interview technique will be used to collect the information. The interview schedule will be formulated and pretested. The interview schedule used for the study will consist of the following sections:

General Information

This will include information regarding their name, age, sex, address, telephone no., religion, education level, occupation, income level, physical activities, consumption of alcohol, type of family, food habits, food like & dislikes etc will be collected.

Medical History

Family history of mild hypertension, mode of onset, symptoms, complications and presence of any other disease.

Nutritional Assessment

Nutritional status refers to the health of individuals as it is affected by the intake and utilization of the nutrients (Robinson 1988).

Nutritional Status Assessment of Subjects with Mild Hypertension

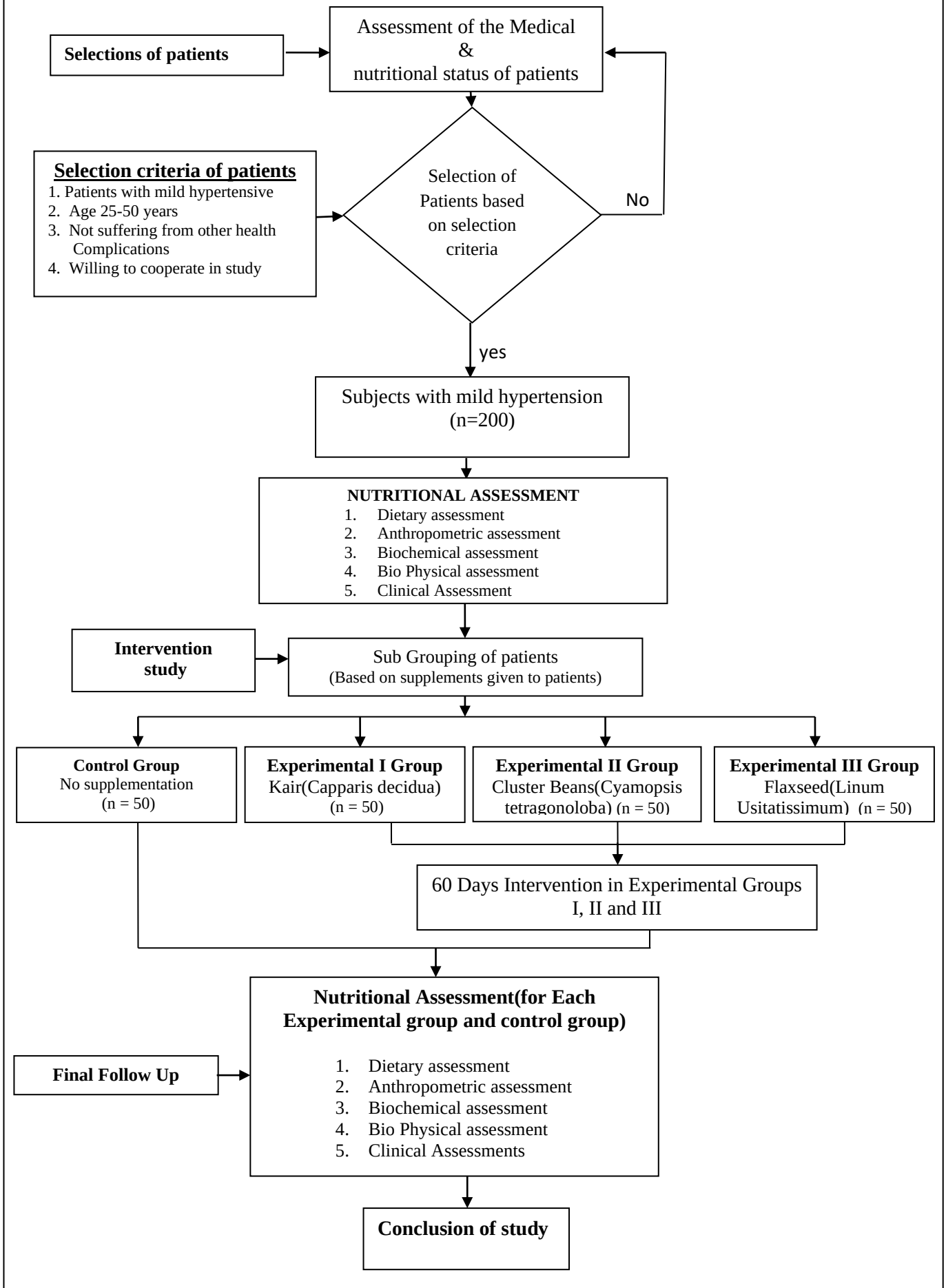
Anthropometric Measurements

Nutritional anthropometry is defined as measurement of human body at various age levels of nutritional status. It is based on the concept that an appropriate measurement should reflect any morphological variation occurring due to a significant functional physiological change(Srilakshmi 2002). It includes the measurements of Height, weight, BMI(Body Mass Index),Waist, Hip, WHR(Waist Hip Ratio).

Bio chemical assessment

Lipid profile and the blood glucose estimation will be done. Blood glucose level and lipid profile values will be measured at a tested laboratory. Blood samples will be analyzed for the estimation of the following parameters using standard kit:

Control randomized Clinical trial study design



- Total cholesterol
- Triglycerides
- HDL- Cholesterol
- LDL- Cholesterol
- VLDL- Cholesterol

Bio physical assessment

Blood pressure will be done. Blood pressure will be measured by trained doctor or a paramedical staff.

Dietary assessment

It is an important method for assessing nutritional status of an individual. It cannot be used alone to make a diagnosis of nutritional status. It plays an important role in the interpretation of anthropometry and clinical assessment and provides a foundation for dietary counseling. Dietary assessment is also an important aspect to predict the nutritional status of population groups belonging to the subjects with mild hypertension(Robinson 1988). It will be done to assess the dietary habits of patients by 24 hour dietary recall method for consecutive days(24 X 3=72 Hours) (ICMR 2010).

Phase 2 Intervention with supplements of 3 Arid Foods

In this phase all 200 subjects will be divided into groups as per following criteria

- ***Control Group(No supplementation) n = 50***
  In this group patients will not be given any food supplement.
- ***Experimental Group1 (Kair supplementation) n = 50***
  In this group the patients will receive the dietary supplement of Kair (Capparis Deciduas). The quantity of the supplement will be 10g dried powder per day.
- ***Experimental Group2 (Cluster Beans supplementation) n = 50***
  In this group the patients will receive the dietary supplement of Cluster Beans (Cyamopsis Tetragonoloba). The quantity of the supplement will be 10g dried powder per day.
- ***Experimental Group3 (Flaxseed supplementation) n = 50***
  In this group the patients will receive the dietary supplement of Flaxseed (Linum Usitatissimum). The quantity of supplement will be roasted seeds 10g per day.

Phase 3 Post Experimental Design and Final Follow up

After two months the effect of dietary supplement on nutritional, biophysical and bio chemical and clinical status will be assessed. The assessment value of individual groups will be checked and compared with standard values in order to find the overall impact of the study.

Statical Analysis of Data

The data will be collected, tabulated, classified and the analysis will be carried out with the help of SPSS. To measure the central tendency use of mean, standard deviation will be done. To compare the pre intervention and the post intervention observation from different parameters i.e. anthropometric measurements, nutrient intake, dietary intake, bio chemical estimation paired “t” test will be used.

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